R E P O R T

on implementation of milestones of the 2nd quarter of the third year
of the Joint Ukrainian-American Scientific Project

" Study of Thyroid Cancer and Other Thyroid Diseases in Ukraine Following the Chornobyl Accident"

(September 1998 - November 1998)

Management and administration

1.9 To prepare continuation of the Agreement according to the Project.

Documents have been prepared, concerning continuation - beginning from July 1, 1998 for 12 months - of Project Partner Agreement between the Science and Technology Center of Ukraine, the Institute of Endocrinology and Metabolism of the Academy of Medical Sciences of Ukraine, and the National Cancer Institute of the U.S.A. on implementation of milestones of the 2nd quarter of the 3rd Year of the Ukr.-Am.

Project "Scientific Protocol for the Study of Thyroid Cancer and Other Thyroid Diseases in Ukraine Following the Chornobyl Accident"

1.10 To apply to the State Administration of the Kozelets raion of Chernihiv oblast in order of providing a coach for transporting cohort members for the period of screening.

A letter from Dr. A. Serdyuk, Minister of Public Health of Ukraine, to the Head of the State Administration of Chernihiv oblast has been prepared, with a request to provide a coach for transporting cohort members in order of screening to the Clinic of the Institute of Endocrinology and Metabolism, Acad. Med. Sci. Ukraine, for the period of screening performance in Kozelets, Chernihiv, and Ripky raions of Chernihiv oblast. The Administration of Chernihiv oblast has taken a decision to provide a coach.

1.11 To ensure printing of Examination Forms in a printing-house.

All screening Forms, intended for 5.000 cohort members, have been printed in printing-house.

1.12 To organize and hold a regular joint meeting devoted to Project implementation (with participation of the Ministry of Public Health of Ukraine, Management and Co-executors of the Project).

A joint meeting of Ukrainian and American participants in the Project, together with representatives of the Ministry of Public Health of Ukraine, has been organized and held on October 28, 1998, devoted to progress in Project implementation, priority areas of further work.

1.13 To work with custom clearance documentation.

Documentation for customs clearance has been prepared for shipments which have been received within the reported period (list of shipments enclosed).

2. The establishment of the cohort

2.7 To complete input of data from paper carriers, obtained as a result of manual search in Chernihiv and Kozelets raions of Chernihiv oblast.

Computer entry of data obtained as a result of manual search in Chernihiv oblast has been completed. For the Kozelets raion of Chernigiv oblast data have been entered on 1796 persons (out of 2089 members of intensive cohort), what makes 86%. The status of the other 293 cohort members is unknown. Out of them 1337 persons are currently living in Kozelets raion (64%). For the Chernihiv raion of Chernihiv oblast data have been entered on 2409 persons (out of 2858 members of intensive cohort), what makes 84%. The status of the other 449 cohort members is unknown. Out of them 1905 persons are currently living in Chernihiv raion (66%). In all, data on 4205 persons have been entered (Kozelets and Chernihiv raions), 3242 of which have not changed their place of residence, what makes 65%.

The status of cohort members found as a result of manual search, is distributed as follows:

Raions	Chernihiv		Kozelets		Total
	N	%	N	%	N
Found	1905	66,7	1337	64,0	3242
Not found(status not defined)	449	15,7	293	14,0	742
Moved to another oblast of Ukraine	25	0,9	17	0,8	42
Moved abroad	22	0,8	13	0,6	35
Moved in unknown direction	253	8,9	88	4,2	341
Provisionally absent in the settlement	33	1,2	50	2,4	83

Died	14	0,5	8	0,4	22
Duplicated	156	5,5	15	0,7	171
Provisionally living in the settlement	1	0,0	268	12,8	269
Total	2858	100,0	2089	100,0	4947

An analysis of the data entered has shown that as a result of manual search, in specifying the date of birth 6 persons born before 1968 have been revealed. These persons have a year of birth which does not meet the criteria of cohort formation.

2.9. To input data from paper carriers, obtained as a result of manual search in Narodychi raion of Zhytomyr oblast.

The Data Coordinating Center has drawn up a program for obtaining and printing of tables which reflect the dynamics of patients' invitation (Appendix 1). The patients are sorted according to the settlements and in alphabetical order.

These tables have been printed according to the dynamics of patients' invitation for the Narodychi raion of Zhytomyr oblast for each settlement. The tables include all the members of the 20.000-cohort who were living in 1986 in Narodychi raion (a total of 4279 persons).

On the request of the American colleagues, the Data Coordinating Center has drawn up a program for calculation of the distribution of the 75.000-cohort's members according to the doses, sex and year of birth. The distribution presents the following aspect:

Dose "A" (<30cGry)

Sex	• male	• Female	Not defined	Total
Year of birth				
1968-1971	2562	3214	1212	6988
1972-1976	7630	8320	3192	19142
1977-1981	5094	5522	2411	13027
1982-1986	2600	2734	1621	6955
Not defined	116	164	88	368
Total	18002	19954	8524	46480

Dose "B" (30cGry<B<100cGry)

Sex	• male	• Female	Not defined	Total
Year of birth				
1968-1971	905	689	204	1798
1972-1976	2571	2276	683	5530
1977-1981	2566	2304	773	5643
1982-1986	2181	2301	873	5355
Not defined	180	181	52	413
Total	8403	7751	2585	18739

Dose "C" (C>100cGry)

Sex	• Male	• FeMale	Not defined	Total
Year of birth				
1968-1971	402	245	39	686
1972-1976	1209	882	109	2200
1977-1981	1229	1114	163	2506
1982-1986	1933	1840	356	4129
Not defined	202	244	103	549
Total	4975	4325	770	10070

3. Invite the subjects for endocrinologic screening

3.1 To ñîntinue invitations by the telephone of the cohort members currently living in Kyiv which were resettled from Chornobyl and Prypyat.

Invitation by the telephone of cohort members currently living in Kyiv and were resettled from Chornobyl and Kyiv continued.

Number and distribution of patients left unexamined in Kyiv.

Date	People left anexamined	Number of people examined in Kyiv	Missing ☎	Wrong ☎	Refuses to come for examination after second invitation	Telephone contacts: total	Were examined in 05.1997
30.12	119	294	41	30	48	650	12
%	28,8	71,2	9	7,2	11,6		2,9
Total 413 persons							

Were send letters of invitation to the cohort members left unexamined – 119.

41- to the patients with unknown telephone number, 30 – to the patients with wrong telephone numbers, 48 – to those who refused to participate while contacted by the telephone.

By 30.11.98 22 cards with reply returned.

19 respondents agreed to participate in the examination and were given the date of appointment .

2 persons refused to participate because they are under medical surveilence in the other medical facility.

1 cohort member is currently living in Brussels. In 1996 she was

operated on because of thyroid cancer and underwent total thyroidectomy in Brussels.

3.2 To obtain consent to take part in screening from cohort members who reside in Îvruch raion, Zhitomir oblast.

Consent to take part in screening was obtained by local medical staff. To the medical staff of Ovruch raion was send a form to clarify reasons of not coming of some subjects to the examination and to assess the possibility of their recruitment into the study. The form and instruction to fill in is in App.1.

Invitation of subjects of Narodichi raion started. Epidemiologists-members of mobile team were receiving the information about the patients who didn't come for the screening from local medical staff during screening and were filling in form 'Dynamics of invitation of patients for the screening' (App. 1)

3.3 To publish in the Ovruch local newspaper an article clearing up the purposes of the screening of the population of Ivankiv raion in the framework of the Ukr.-Am. Project.

In the Ovruch local newspaper was published an article about goals of the Ukr.-Am project.

3.4 To give a broadcast talk on the local radio of Ovruch raion in order to inform the population about purposes and tasks of the Ukr.-Am.

Thyroid Project.

Was given broadcast talk on the Ovruch local radio with the information about purposes and tasks of the Ukr. - Am. Project.

On the basis of the information received on consent to take part in the screening, to make a schedule of screening of the population of the Ovruch raion, and Kyiv which was resettled from Chornobyl and Prypyat.

Schedule of the examination of the population of the Ovruch raion was made by local medical staff based on their personal contacts.

Schedule of examination of the subjects, currently living in Kyiv, was made be members of epidemiology group based on the telephone contacts and correspondence.

Endocrinologic examination of the subjects

4.3 To continue screening by stationary team of cohort members who have been evacuated from Chornobyl and Prypyat to Kyiv.

4.5 To continue screening by mobile teams of cohort members who are residing in Ovruch raion.

Place of screening: Zhytomyr oblast, Ovruch raion: village Khluplyany, village Sloboda, village Pershotravneve, city of Ovruch, village Bondary, village N. Velednychy, village Pokaliv, village V. Chernihivka, village Ignatpil.

Clinic of the Institute of Endocrinology and Metabolism (persons evacuated from the city of Prypyat)

Number of persons examined: 906

Diffuse goiter, degree 1: 226 persons

Diffuse goiter, degree 2: 55 persons

Nodular goiter, degree 1: 3 persons

Nodular goiter, degree 2: 9 persons

Mixed goiter, degree 1: 1 person

Mixed goiter, degree 2: 4 persons

Autoimmune thyroiditis: 1 person

Postoperative hypothyroidism: 1 person

Mixed goiter, degree 2: 1 person - examination and treatment have been performed at the Institute of Endocrinology and Metabolism.

Papillary thyroid carcinoma: 1 person (clinical treatment until November 24, 1998).

Operation of the Central Laboratory

5.2 To perform all the laboratory tests in the process of screening.

The following examinations have been performed by the Central Laboratory:

a) blood hormone level:

Thyrotropin: 417 persons

Thyroglobulin: 228 persons

Anti-TPO: 418 persons

b) Ca++ level and pH in blood: 960 patients.
FNAB of thyroid nodules has been performed in 10 patients.
Thyroid cancer has been revealed in one person.

6. Operation of Data Coordinating Center

6.1. To complete installation of software and hardware.

A second network adapter has been installed on Windows NT 4.0 server. Two subnets of C class have been determined (the first subnet for the server and 5 work stations, the second one for the server, printer and old computers). A 10Mb/s repeater (HUB) has been connected to the second subnet. A printer Minolta PagePro 12 has been connected to the 10Mb/s segment of network. IP addresses in the framework of C class network have been determined for all work stations and printer. In the operation system Windows NT 40 static tables of routing have been described so that the computers of both subnets might have access to each another and to the printer. Utility Minolta TCP/IP networking has been installed and adjusted on work stations. At present, the printer is operating in real network regimen.

Operation system Windows 95 and necessary program packets for 3 working stations Deskpro 4000S (P2200; 32 PAM; 3,1Gb;15") have been installed; one computer has been installed in Project Office; HP Laser Jet 5L printer has been connected to it, and necessary software has been installed.

A device for recording USI images on magneto-optical discs has been connected and adjusted to USI-apparatuses TOSBEE & HITACHI. Staff (physicians and USI operators) has been trained for operation with the image recording device Camtronics.

One of the old computers has been provided to the translator. Because of its insufficient power, an operation system Window 3.11 and version 6.0 MS Word have been installed on it.

6.2. To complete study and management of the database InterBase server.

DBMS InterBase has been installed on the server. The language of structured requests SQL has been studied, as well as InterBase Interactive SQL. The server has been configurated for access of 4 clients, rights to access to DataBase have been established.

6.3. Recompilation of available databases into InterBase format.

DataBase has been translated into InterBase format. To date, the base is available in two versions:

an old version in PARADOX format;

a new version in InterBase format.

So far, the old version of database is used, because, for using new databases in InterBase format, it is necessary to transfer all existing programs on SQL platform. This requires additional work and time for programming.

6.13. To work out a complex of programs for the Pathology Group.

Necessary software has been installed on one of the old computers, and this computer has been provided to the Pathomorphology Department. At present, the computer is operating separately from the network. This is due to technical difficulties of connecting a 10 Mb/s network adapter to the available 100 Mb/s network.

Due to the necessity of working out programs for Screening Forms, realization of Pathology Form has been postponed to later terms. This milestone will be implemented as soon as programs for input of Screening Forms will be developed.

6.14. To work out a database and computer form of input of data for the Locator Form.

A database structure for storage and input of data from paper version of Locator Forms has been developed. The base's structure presents the following aspect:

NAME OF FIELDS	TYPE	COMMENTS
ID	A(8)*	Identification number
Date	D *	Date of completion of the Form
KOD_ZAP	A(3)	Code of the operator having completed the Forms
KOD_INPUT	A(3)	Code of the operator having input data in computer
MS_OBSLED	S	Place of examination: 0- Polyclinic of IE&M 1- Mobile team
NEXT_DATE	D	Date of presumed leaving

NEXT_NP	A(8)	Code of presumed settlement after leaving
NEXT_COMMENT	Memo	Comments
NEXT_ADRESS	A(30)	Address of presumed place of residence. Includes: Street, Building, and Apartment.
FIO_86	A(15)	Surname in 1986
OTHER _NP	A(8)	Other place of residence. Includes: code of Oblast, Raion, Village Council, Settlement
OTHER _ADRESS	A(30)	Other place of residence. Includes: Street, Building, and Apartment.
WORK_PLACE	Memo	Patient's place of work/studies
PROFESSION	Memo	Profession (position)
WORK _NP	S	Office address. Includes: code of Oblast, Raion, Village Council, Settlement
WORK _ADRESS	A(30)	Office address. Includes: Street, Building, and Apartment
RAY_POL_N	S	Number of patient's raion polyclinic
RAY_POL_TIP	S	Polyclinic's type: 0- for children 1- for adults
RAY_POL_NP	S	Polyclinic's address. Includes: code of Oblast, Raion, Village Council, Settlement
RAY_POL_ADRESS	A(30)	Polyclinic's address. Includes: Street, Building, and Apartment
RAY_POL_ TEL	A(12)	Polyclinic's telephone number

DB structure "Patient's relations" RODSTVO.DB

- contains information on patient's relations. Used in "Locator Form". (* - key fields)

NAME OF FIELDS	TYPE	COMMENTS
ID	A(8)*	Identification number
Data	D *	Date of completion of the Form
RODSTVO	S *	Degree of relationship: 0-Mother 1-Father 2-Brother/Sister 3-Husband/Wife 4-Other
FAM	A(15)	Surname
IM	A(10)	First name
OT	A(15)	Patronymic
TEL	A(12)	Telephone number of patient's relation
NP	S	Relation's address. Include: code of Oblast, Raion, Village Council, Settlement
ADRESS	A(30)	Relation's address. Includes: Street, Building, and Apartment
GENERAL_NOTES	Memo	General notes

DB structure "Patients' telephones" TELEFON.DB
- contains patients' telephone numbers.
(* - key fields)

NAME OF FIELDS	TYPE	COMMENTS
ID	A(8) *	Identification number
TIP	S *	Telephone type: 0- Home 1- Office 2- School 3- Other
TEL	A(12)	Telephone number of patient's relation
GENERAL_NOTES	Memo	General notes

A program for input of data from the paper version of the Locator Form into the database of the Project has been created. This program maximally controls the completeness of all necessary fields of Form and performs quality control (it does not allow input of incorrect data, settlements).

A database's structure for storage and information on the dynamics of invitation and status of cohort members has also been developed:

NAME OF FIELDS	TYPE	COMMENTS
ID	A(8)*	ID
DateFirstCont	D	Date of first contact
Result	S	Result (examination, etc.)
REFIUSE	S	Cause of refusal to participate in screening
DateNextCont	D	Date of next contact
ResultNext	S	Result of next contact
KODTEAM	S	Code of the team having performed examination
NOTE	M	Note

as well as a DB of schedule and composition of mobile teams.

DB structure "Schedule and composition of mobile teams"
MOBTEAMS.DB
(* - key fields)

NAME OF FIELDS	TYPE	COMMENTS
KodTeam	S*	Team's code (1 - fixed team)
DateOut	D	Date of departure
DateIn	D	Date of return
HEADS	S	Team head's code
NP_EXAM	A(8)	Settlement where examination has been performed
EXAMENED	S	Number of subjects examined

DB structure "Mobile teams' composition" SUBTEAMS.DB (* - key fields)

NAME OF FIELDS	TYPE	COMMENTS
KodTeam	S*	Team's code
MEMBERKOD	A(3)	Team member's code

The Data Coordinating Center has begun input of screening data (Locator Forms) in the database of the Project.

In addition, DCC has prepared a database for the persons who are residing in Kyiv but do not have a telephone, or give their verbal consent but do not come to examinations (119 potential cohort members).

A program has been developed for printing post-cards and printing addresses on envelopes. On the base of the above-mentioned base, 119 invitations, post-cards and envelopes for potential cohort members have been printed.

Pathology support for diagnosis of various forms of thyroid pathology.

7.1. To continue collecting and pathological examination of morphologic material from all patients born in 1968 and later from cohort oblasts and having been operated at the Institute of Endocrinology for different thyroid diagnoses. Pathomorphologic analysis of collected material.

Collection of biopsy material has been continued in the form of paraffin blocks and histological preparations from patients born in 1968

and later, who reside in Kyiv oblast (including city of Kyiv), Chernihiv, Zhytomyr oblasts and have been operated at the Clinic of the Institute of Endocrinology during the reported period for different types of thyroid pathology. For the period September-November 1998, material from 31 cases of surgical thyroid pathology has been collected. They include 9 cases of thyroid carcinoma (one case from Kyiv oblast, 2 from Chernihiv oblast, 2 from Zhytomyr oblast, and 4 from the city of Kyiv); 5 cases of follicular adenoma (3 from Chernihiv oblast, one from Zhytomyr oblast and one from the city of Kyiv); 11 cases of nodular goiter (5 from Kyiv oblast, one from Chernihiv oblast, 2 from Zhytomyr oblast, and 3 from the city of Kyiv); 2 cases of multinodular goiter (one from Kyiv oblast and one from the city of Kyiv); and 4 cases of diffuse toxic goiter (one from Kyiv oblast, one from Zhytomyr oblast, and 2 from the city of Kyiv).

With diagnostic purpose, 250 blocks have been embedded in paraffin, and more than 500 histological preparations have been studied at light microscope.

8 from 9 (89 %) of the studied cases of thyroid cancer represented a papillary carcinoma. 3 tumors of this type were removed in children aged 12-13 years (at the time of the accident these children were aged from 5 months to 1 year and 5 months), and 5 tumors were removed in young adult patients aged 22 to 29 years.

As to their histological structure, the papillary carcinoma in children has been verified in one case as an oxyphilic-cell follicular variant, in one case it was a mixed papillary-follicular structure, and in one case a typical papillary structure, oxyphilic-cell variant. It should be noted that in 2 from 3 cases in children, metastases in regional lymph nodes were reported.

In adult patients 2 from 5 cases of papillary carcinoma had a typical papillary structure, in one case a solid structure, in one case a mixed papillary-follicular structure, and in one case a diffuse-sclerosing variant of papillary carcinoma was noted. In 3 cases there were signs of a concomitant chronic thyroiditis. Metastases in regional lymph nodes in adult patients were reported in 4 cases.

A minimally invasive follicular adenoma has been verified in one patient (female) aged 25 years from the city of Kyiv.

Two follicular adenomas with microfollicular and solid structure were reported in children aged 13-14 years; two follicular adenomas of heterogenous structure with areas of papillary hyperplasia and oxyphilic-cell proliferation, and with microfollicular-solid structure in adolescents aged 15 and 17 years, and one normofollicular adenoma in an adult patient (fenale) aged 28 years.

Nodular solitary goiters have been established in 3 children aged 13-14 years and in one child aged 11 years (a girl from Kyiv oblast born in 1986, i.e. "in utero" at the time of the accident); in one adolescent aged 16 years, and in 6 adult patients aged 20 to 28 years. The goiters had a dominant macro-normofollicular structure with presence of cystic cavities. Only in 3 cases there were no signs of cystic transformation.

A multinodular goiter of heterogeneous histological structure with presence of cystic cavities has been verified in one boy aged 13 years and in one adult patient (female) aged 29 years.

Diffuse toxic goiter was present only in young adult patients aged 20 to 28 years. In all cases there were signs of alveolar papillary hyperplasia,

sclerotic changes, and in 2 cases signs of a concomitant chronic thyroiditis were noted.

7.2. Preparation of additional histological specimens for the morphologic data bank of the Ukr.-Am. Project from patients including in the cohort.

A detailed information on the above cases, which included patient's passport data, exact date of birth, place of residence during the accident and to date, has been provided to the Dosimetry Department of the Scientific Center of Radiation Medicine and to DCC in order to identify persons who had direct measurements of thyroid activity and were included in the cohort. It has been established that among the subjects who have been operated within the reported period, 2 patients belonged to the cohort under study. One of them, a male born in 1972 (group "C" of the 20000-cohort), from the Ovruch raion of Zhytomyr oblast has been operated on for an encapsulated papillary carcinoma of solid structure, and the second patient, a female born in 1976, also from the Ovruch raion of Zhytomyr oblast (group "A" of the 75000-cohort) has been operated on for a nodular solitary goiter of heterogeneous histological structure. Additional histological preparations have been prepared from the paraffin blocks of the above cases for the morphologic data bank of the Ukr.-Am. Project.

Thus, in the morphologic data bank of the Ukr.-Am. Project, among the cases identified in the cohort, at present moment 23 cases of thyroid carcinoma and 9 cases of benign pathology (2 follicular adenomas, 3

multinodular goiters, 3 nodular solitary goiters, and one diffuse toxic goiter) are established.

Together with DCC, an additional analysis of the above cases has been made as regards the distribution of patients in the 20000-cohort, 75000-cohort, and general 100000-cohort.

So, among 23 cases of thyroid carcinoma, 10 (43.5 %) belong to the 20000-cohort (group "C"), 8 cases (34.8 %) to the 75000-cohort (3 cases in group "B" and 5 cases in group "A"), and 5 cases (21.7 %) belong to the general 100000-cohort (one case in group "C", one case in group "B", and 3 cases in group "A").

Among 9 cases of benign thyroid pathology, 5 cases (55.6 %) belong to the 75000-cohort (one case in group "B" and 4 cases in group "A"), and 4 cases (44.4 %) belong to the general 100000-cohort (all the cases in group "B").

7.3. To ensure intraoperational diagnosis, histological processing and pathomorphologic analysis of specimens received from patients selected for surgery after screening. Preparation of additional histological specimens for the morphologic data bank of the Ukr.-Am. Project.

Screening examinations performed to date allowed to identify only one patient for surgery, a girl born in 1984 from the Ovruch raion of Zhytomyr oblast, with presence of a thyroid nodule, and, according to FNAB results , a thyroid carcinoma was suspected in this case. This girl has been hospitalized at the Department of Children's Endocrine Pathology of the Institute, and the operation was scheduled for December

1, 1998. The report on the morphologic structure of the tumor will be presented in the next quarter.

7.4 To fill in the Pathology Forms for the patients with revealed cases of thyroid pathology, included in the cohort under study. To set these data into the computer and provide them to DCC (after receipt of computers).

The Pathology Forms for the above cases have been filled in on paper. The Laboratory has been provided with a computer which was formerly (before installation of new modern equipment) used in DCC. After the DCC staff will have developed the appropriate programs, the Forms will be completed on computer, but so far data transfer to DCC is impossible, because there are problems with network communication and incompatibility of diskette size between the computer provided to the Laboratory and new computers installed in DCC.

DOSIMETRY SUPPORT OF THE "UKRAINIAN-AMERICAN SCIENTIFIC PROJECT ON THE STUDY OF CANCER AND OTHER THYROID DISEASES IN UKRAINE AS A CONSEQUENCE OF THE CHORNOBYL ACCIDENT"

8.7. to support the questionnaire db. questioning, input and computer support of questionnaires' information. dose reconstruction on the basis of questionnaire data.

In the second quarter of the 3rd year of Project implementation, 943 persons have been questioned. Questioning was performed by interviewers from mobile teams which were operating in settlements of the Ovruchs'kyi raion of Zhytomyrs'ka oblast (773 persons questioned), as well as at the Institute of Endocrinology and Metabolism (170 persons questioned). Among these 943 persons, 716 were subjects who were aged under 10 years at the time of the accident.

The distribution of the questionnaires collected in the 2nd quarter, according to the regions of location of the persons questioned during the accident, is shown in Table 8.7.1. The total number of questionnaires collected in the process of Project implementation, and their distribution is given in Table 8.7.2.

Table 8.7.1. - Distribution of questionnaires collected in the 2nd quarter of the 3rd year of Project implementation, according to the regions of location during the Chornobyl accident

Location of the persons during the Chornobyl accident	Number of questionnaires collected	Including: number of questionnaires of persons who were aged under 10 years at the accident
Ovruchs'kyi raion, Zhytomyrs'ka oblast	773	585
City of Prypyat'	153	121
Chornobyl's'kyi raion, Kyivs'ka oblast	15	8
Ivankivs'kyi raion, Kyivs'ka oblast	1	1

Polis'skyi raion, Kyivs'ka oblast	1	1

Table 8.7.2. - Total number of questionnaires collected in the process of Project implementation and their distribution according to the regions of location during the Chornobyl accident

Location of the persons during the Chornobyl accident		Number of question-naires collected
Kyivs'ka oblast	City of Prypyat'	260
	Chornobyls'kyi raion	15
	Ivankivs'kyi raion	183
	Polis'skyi raion	1
Cherhihivs'ka oblast	Kozelets'kyi raion	105
Zhytomyrs'ka oblast	Ovruchs'kyi raion	773
Total		1337

8.15. VERIFICATION OF THYROID MEASUREMENTS. DEVELOPMENT OF A TECHNIQUE FOR RETROSPECTIVE ASSESSMENT OF "DEVICE"-SPECIFIC ("LIST"-SPECIFIC WHERE IT IS POSSIBLE) CALIBRATION FACTORS FOR DEVICES WITH FAILED DATA OF CALIBRATION.

After having analyzed all the data for devices' calibration factors available in Lists, we have classified and divided them into three calibration classes.

1. The List contains all the data on the date of preparation of source, its activity, and the results of measurements of the control source are available; the calibration factor may be calculated.
2. The List contains the calibration factor written down by the dosimetrist, but it is impossible to verify it because of lack of necessary calibration data. Such factors are found for spectrometric devices which have been used for measurements at early stages of thyrodosimetric monitoring. We think that in these cases calibration was performed before going to the place of measurements.
3. The Lists pertaining to SRP-68-01 type devices do not include calibration data. One uses as calibration factor for such Lists a universal factor equal to 6.25 10^{-3} $\mu Ci \times R^{-1} \times h$.

The Table 8.15.1. shows the distribution of all available Lists with measurements

according to the type of device (spectrometric, non spectrometric) and calibration class.

Table 8.15.1. - Distribution of calibration factors according to the type of device and calibration class

Device's type	Calibration class according to calibration factor (CF)	Number of Lists*	% of measu-rements
Spectro-meter	Class 1. CF can be verified	245	23%
	Class 2.Verification of CF is impossible	65	13%
Counter (SRP)	Class 1. CF can be verified	194	17%
	Class 3. Universal for all device average CF	573	47%

* 10 Lists performed using non spectrometric devices of DP-6A and PRL types (0.15% of measurements) have been excluded being considered as Lists containing measurements of uncertain quality.

We think that one of the reasons of such an uncertainty of dose estimates obtained for measurements made with SRP-68-01 devices is due to the following fact. Even after a retrospective restoration of the results of calibration of SRP-68-01 devices, calibration data are still missing for 573 Lists (74 % of measurements made with devices of this type, or 47 % of all measurements). One uses for these a universal calibration factor for all SRP-68-01 devices equal to 6.25 10^{-3} μCi h $μR^{-1}$.

Formerly (see the report for the 4th quarter of the 2nd year of Project implementation, milestone 8.14.2.2), we noted that the counting efficiency for different SRP-68-01 devices significantly differed, and application of a universal calibration factor for all devices is not advisable. We see a solution of this problem in dividing all the devices with missing calibration data into groups, with subsequent use, within each group, of its own average calibration factor which is specific for this group.

In order to ascertain the correctness of division of all devices with missing calibration data on groups, we have analysed the routs of displacements of dosimetric teams, concrete team members and certain devices on the areas of measurements. We have also analysed the cases of use of each device in several teams; the cases of

operation of each dosimetrist with different devices; the cases of operation of each dosimetrist when included in several teams. One used for this analysis information on dosimetric team's code, dosimetrist's personal signature and device's serial number available in primary records and set, in the process of implementation of previous stages of work, into the DB MEASUR (report for the 4th quarter of the 2nd year of Project, milestone 8.14.1.1).

The thyroid monitoring measurements of children who had been during the accident in 8 regions of Ukraine established by the Protocol of cohort screening and in the city of Prypyat, have been performed on the territories of the city of Kyiv and 13 regions of Ukraine: Zhytomyrs'ka , Kyivs'ka, Chernihivs'ka, Rivnens'ka, Vinnyts'ka, Khmelnyts'ka, Ternopil's'ka, Lvivs'ka, Sums'ka, Odes'ka, Donets'ka, Zaporizhs'ka oblasts, and Crimea (enumeration of dosimetric teams is given in Table 8.14.1 of the report for the 4th quarter of the 2nd year of Project). The codes of teams which have operated in each oblast, consisted of the first letter (or two first letters) of the name of the oblast and of team's number.

It has been established that:

(a) The same device might have moved from one team to another, but only within the territory of one oblast. The displacement of a same device in different raions within one oblast was also a usual occurrence. The Table 8.15.2 gathers all the cases where the same device was used by several dosimetric teams; as seen from the Table, each of devices was used only in teams of one oblast. Only one device (UR 1-3 Serial # 912001) is an exception, having been used for measurements in three oblasts.

TABLE 8.15.2-LLIST OF DEVICES WHICH HAVE BEEN USED IN SEVERAL DOSIMETRIC TEAMS

Device	Device's serial number	Dosimetric teams having used the device	Oblasts where dosimetric teams were operating
GTRM-01ts	32	ch-1, ch-14	Chernihivs'ka
NK-150	71077	ch-10, ch-16, ch-3	Chernihivs'ka
NK-350	81031	ch-11, ch-12	Chernihivs'ka

UR 1-3	912001	k, lv-1, ch-3	Kyivs'ka, Chernihivs'ka, Lvivs'ka
SRP-68-01	1727	kr-1, kr-2, kr-9	Crimea
SRP-68-01	2113	o-1, o-17	Odes'ka
SRP-68-01	863	o-1, o-18	Odes'ka
SRP-68-01	1086	o-1, o-2	Odes'ka
SRP-68-01	2085	o-10, o-4	Odes'ka
SRP-68-01	1670	o-12, o-2, o-9	Odes'ka
SRP-68-01	125	zh-1, zh-2, zh-3	Zhytomyrs'ka
SRP-68-01	149	zh-1, zh-2, zh-3	Zhytomyrs'ka
SRP-68-01	268	zh-1, zh-2, zh-3	Zhytomyrs'ka
SRP-68-01	914	zh-3, zh-4	Zhytomyrs'ka
SRP-68-01	1385	zh-4, zh-5	Zhytomyrs'ka
SRP-68-01	268	zh-5, zh-8	Zhytomyrs'ka
SRP-68-01	854	zh-7, zh-8	Zhytomyrs'ka

(a) The dosimetrists also moved from one team to another (one dosimetrist might have worked in four different teams) and from one raion to another, but only within one oblast. Only one case is an exception to the rule, when a dosimetrist made measurements on the territory of two oblasts. This dosimetrist was operating with the above-mentioned device UR- 1-3, Serial # 912001.

An analysis of displacements of dosimetric teams, concrete dosimetrists and devices on the territories of measurements allowed to draw the following conclusion. In spite of the fact that the direction of measurements of thyroid activity on the Ukrainian territory was a centralized one, in each oblast where measurements were performed a local dosimetric group and kit of measuring devices were formed. All the above-mentioned allows to consider kits of devices and features of measurements which are specific for concrete oblasts of measurements.

THE FIG. 8.15.1 GIVES LIST-SPECIFIC CALIBRATION FACTORS (*CF*) FOR SRP-68-01 DEVICES, WHICH ARE CLASSIFIED ACCORDING TO THE OBLASTS WHERE MEASUREMENTS WERE PERFORMED. AS APPEARED FROM THIS FIGURE, THE FACTORS IN DIFFERENT OBLASTS ARE ON DIFFERENT LEVELS. THE AVERAGE *CF* FOR OBLASTS SIGNIFICANTLY DIFFER FROM THE AVERAGE FACTOR EQUAL TO 6.25 10^{-3} μCI H μR^{-1} WHICH WAS ADOPTED FOR CALCULATIONS. THE VALUES OF AVERAGE *CF* FOR OBLASTS WERE EQUAL:

FOR ZHYTOMYRS'KA OBLAST – 7.34 μCI H μR^{-1}, VINNYTS'KA OBLAST – 12.49 μCI H μR^{-1}, CRIMEA – 2.38 μCI H μR^{-1}, LVIVS'KA OBLAST – 1.39 μCI H μR^{-1}, ODES'KA OBLAST - 3.79 μCI H μR^{-1}, RIVNENS'KA OBLAST – 3.13 μCI H μR^{-1}.

In our opinion, this is due to the fact that in each oblast a group of dosimetrists was formed for the teams of this oblast. Therefore, in different oblasts a different geometry of measurements might have been used, for instance: the prominent part of the collimators might have been different, and, therefore, the efficiency of registration was also different.

As a result of the analysis, it has been decided that for SRP-68-01 devices with missing calibration data, oblast-specific calibration factors may be used instead of a universal calibration factor for all devices.

In order to verify the correctness of this decision, we have analysed 1550 results of double measurements, when the thyroid was measured in the same person simultaneously with two devices: a spectrometric one and SRP-68-01. One may see on Fig. 8.15.2, as an example, the results of assessment of average age-dependent doses in a couple of measurements made with spectrometric devices NK-350 #82014 and SRP-68-01 #1757 (inhabitants of Vyshgorod and Makarov raions of Kyivs'ka oblast evacuated to the Crimea,

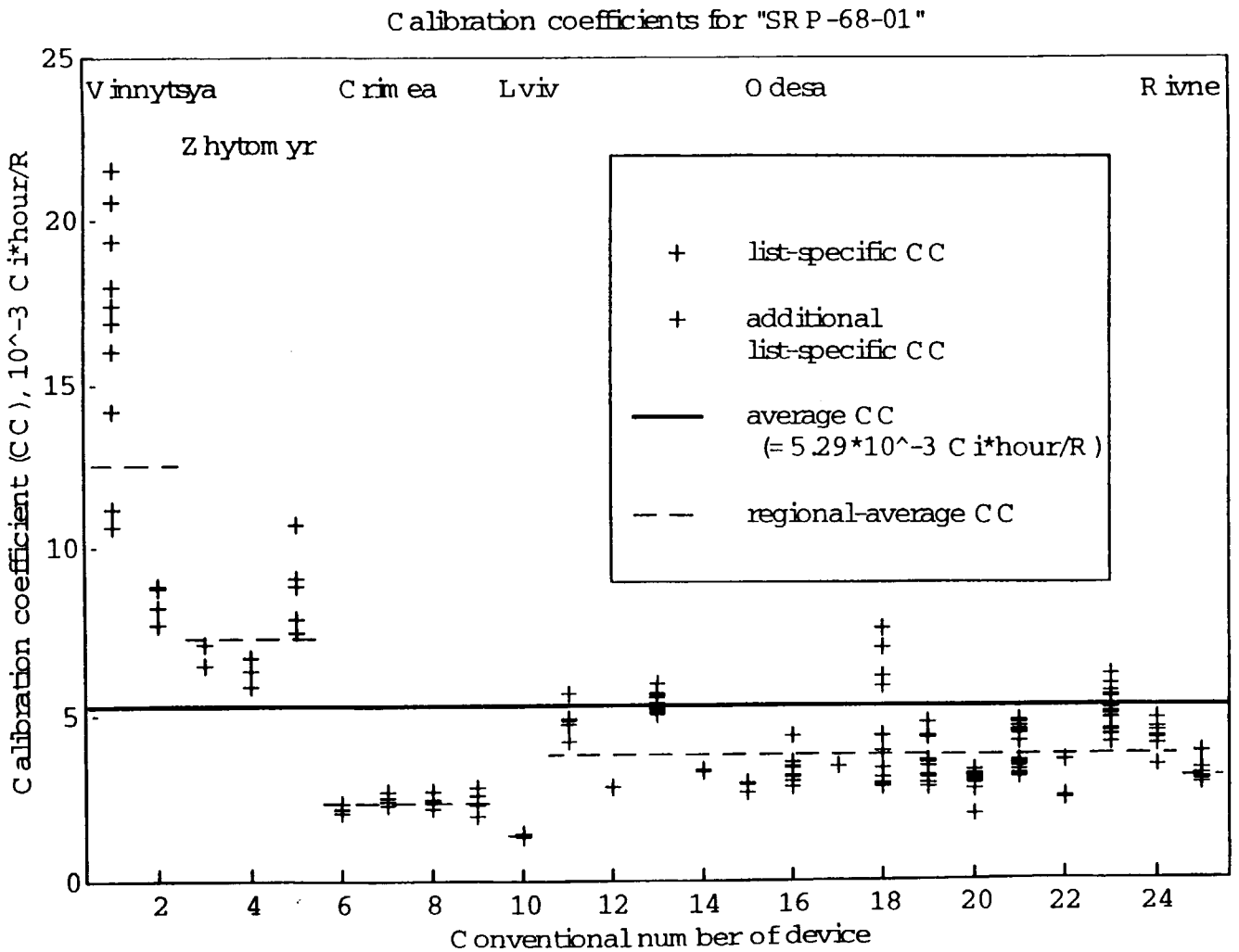


Fig. 8.5.1. Calibration factors of SRP-68-01 devices classified according to the oblasts of measurements.

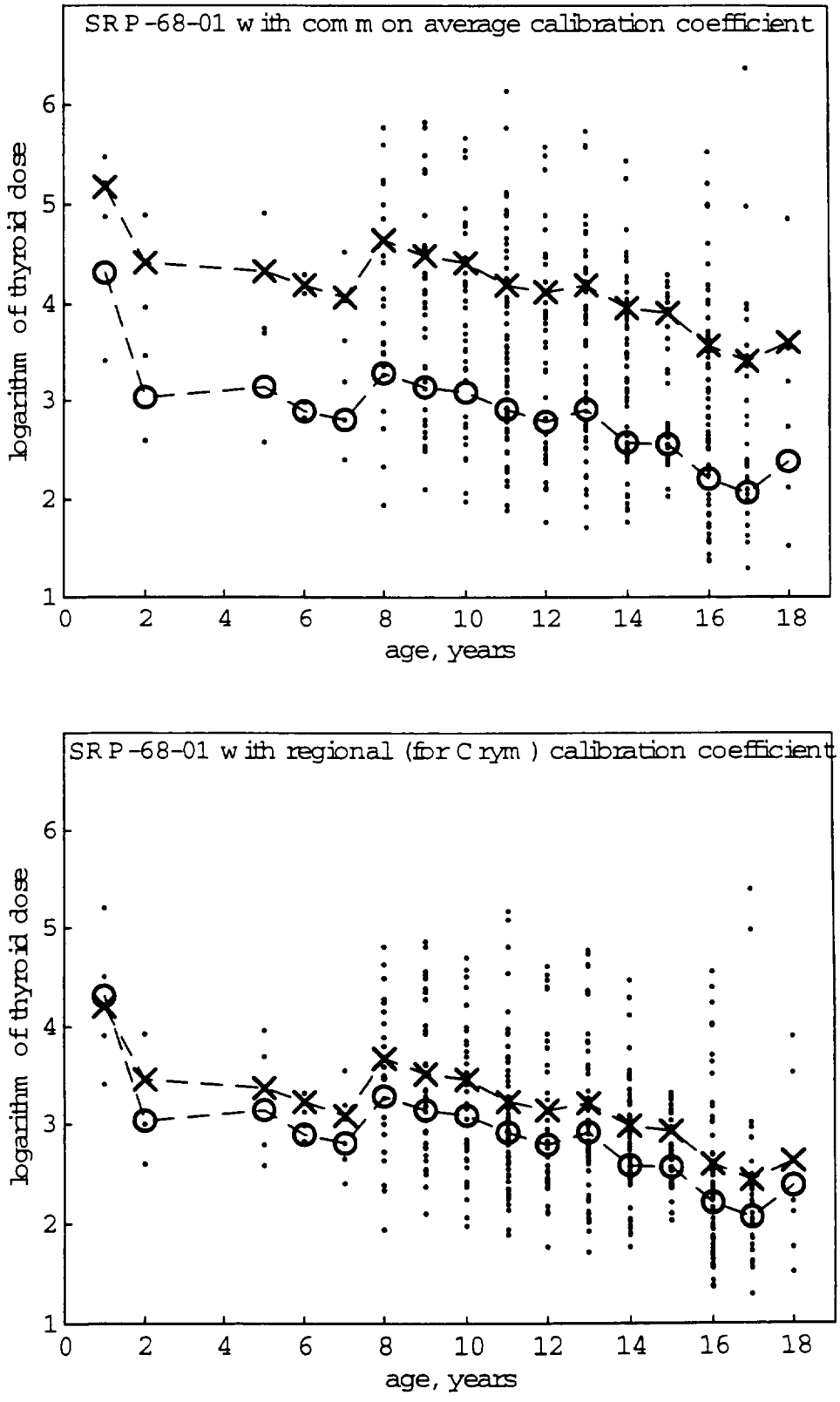


Fig. 8.15.2. Age-dependent average doses calculated according to the data of spectrometric and non

spectrometric measurements made simultaneously in the same persons (circles: NK-350, crosses: SRP-68-01).

258 couple of measurements). Upper part of the figure: there was no *CF* for SRP-68-01 #1757, and one used the old average factor for all SRP equal to 6.25 10^{-3}. One may see that the doses calculated according to SRP-68-01 data are higher for all ages. It has not been additionally found results of calibration for the device with this serial number, and on the lower figure an oblast-specific average *CF*=2.38 10^{-3} μCi h μR^{-1} for Crimea has been used for it. As appeared, it significantly improves the correspondence of spectro- and non spectrometric data.

Unfortunately, oblast-specific calibration factors for SRP-68-01 devices may have been calculated only for 6 from 13 oblasts where measurements had been performed. It was also impossible to calculate it for the devices, which had been used in the city of Kyiv.

Therefore, we tried to develop a technique for restoration, where it is possible, of the device-specific calibration factor for a device with a concrete serial number, if it had no calibration data. The technique uses the procedure of comparative analysis for the doses calculated according to the data of measurements with different devices on samples of the same type (as concerns location at the time of the accident and age), of subjects measured.

The procedure of comparative analysis includes the following steps:

1. Forming of samples of results of measurements of doses performed with devices with available results of calibration and calculated *CF* (**high quality**) and a device with a concrete number and unknown or tested *CF* (**low quality**). The samples are formed provided that measurements are to be performed in the same Local Council (*LC*), in the same age group, in number of at least 12 measurements of each quality.
2. For each Local Council (*LC*) and each age group (*age*) the correction factor K is calculated:

   $$K(age,LC)=\frac{D_{low}(age,LC)}{D_{high}(age,LC)}$$

   where $D_{low}(age,LC)$ is the average dose of low quality in the *LC* in question and age group in question;

   $D_{high}(age,LC)$ is the average dose of high quality in the *LC* in question and age group in question.

3. One considers the distribution of values $K(age,LC)$, and one uses, as its characteristic, the robust estimate of its median. The median value $K(age,LC)$ of distribution is used as correction factor to the calibration factor which was formerly used for the device with the serial number in question, if it differs more than by 30 % from 1.

This technique is intended for specifying the calibration factors both for SRP-68-01 devices with missing calibration data, and for spectrometric devices referred to Class 2 (Table 8.15.1).

Conclusions:

- The difference in doses calculated according to spectrometric and non spectrometric data is mainly due to lack of true device calibration factors and to their replacement by an average universal calibration factor for all SRP-68-01 devices..
- For Lists of measurements with SRP-68-01 devices with missing calibration data, one suggests to use device-specific or oblast-specific calibration factors. Use of device-specific or oblast-specific calibration factors allows to correct to a considerable degree the results of non spectrometric measurements.
- A technique has been developed for restoration of device-specific calibration factors for SRP-68-01 devices with a concrete serial number and missing calibration data. This technique provides for a procedure of comparative analysis of doses calculated on samples of the same type according to the results of measurements with devices having known calibration factors and the device tested. The application of this technique is planned for the following quarter of investigations.

8.18 PARTIAL COLLECTION OF THE DATA NECESSARY FOR ASSESSMENT OF DOSES OF EXTERNAL AND INTERNAL (FROM ^{137,134}CS) EXPOSURES FOR THE MEMBERS OF COHORT. CREATION OF GEOCODED DB RADIOECOLOGICAL FEATURES FOR UKRAINE SETTLEMENTS FROM RAIONS UNDER STUDY.

The Laboratory of Dosimetry Models and Radiation Prognosis of the Department of Dosimetry and Radiation Hygiene has provided materials necessary for assessment of doses of external and internal exposure from radiocaesium isotopes. These data include:

a) Reference values of ^{137}Cs soil deposition on settlements' territories ;

b) System of referent age-dependent behavior factors.

c) System of referent transfer factors reflecting radiocaesium transfer from soil to the locally produced milk;

d) Referent age-dependent alimentary rations of inhabitants;

e) Referent function of changes in the time of standard milk equivalent of inhabitants' ration.

The data obtained for referent values of ^{137}Cs soil deposition and for referent trasnfer factors have been geocoded and they represented a basis for calculation of doses of external gamma-exposure and internal exposure from radiocaesium for members of those cohorts for which one plans to obtain total thyroid exposure doses.

The referent values of density of ^{137}Cs soil deposition (σ_{Cs}) and of transfer factors (k_m) were available for more than 99 % and 83 % from 637 settlements in raions under study, respectively (Table 8.18.1). For 3 settlements for the value σ_{Cs}, and for 100 settlements for the value k_m , these necessary parameters for obtaining dose estimates were found using the method of geostatical interpolation procedure [1]. These parameters may be furtherly specified using additional information on direct measurements of ^{137}Cs concentration in milk. Fig. 8.18.1 to 8.18.3 show spatial distribution of transfer factors "soil-milk" in the raions under study.

Information for settlements, which are not included in the number of settlements studied according to the Project, will be additionally used, as these settlements will be mentioned in personal questionnaires concerning the regime of behavior of cohort members.

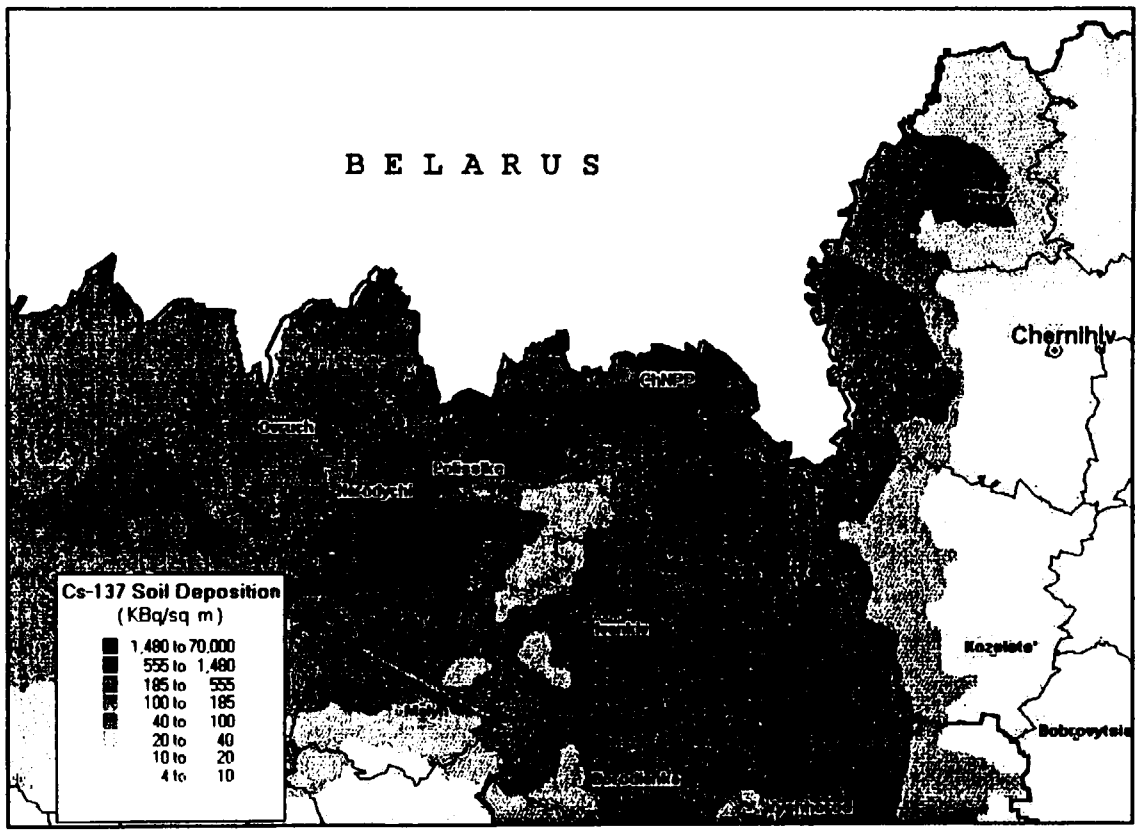
Furtherly, the question of the contribution of external gamma-exposure and internal exposure from radiocaesium for the inhabitants of Prypyat and 30-km zone is also to be answered. In order to

resolve this problem, it is necessary to use additional data on the dynamics of gamma dose-rate in Prypyat and 30-km zone. We plan to deal with this matter

Table 8.18.1. – Distribution of data on ^{137}Cs soil contamination and estimates of ^{137}Cs "soil-milk" transfer factors for 7 raions under study

Oblast	Raion	Number of settlements with data on ^{137}Cs soil contamination			Number of settlements with data on "soil-milk" transfer factors		
		Data on direct measurements	Reconstructed data	Total	Data based on direct measurements	Reconstructed data	Total
Kyivs'ka	Ivankivs'kyi	75	-	75	72	3	75
	Polis'skyi	40	1	41	25	16	41
Zhytomyrs'ka	Narodychs'kyi	73	-	73	55	18	73
	Ovruchs'kyi	134	2	136	128	8	136
Chernihiv-s'ka	Kozelets'kyi	101	-	101	77	24	101
	Ripkins'kyi	105	-	105	92	13	105
	Chernihivs'kyi	106	-	106	88	18	106
Total		634	3	637	537	100	637

Figure. 8.18.1. ^{137}Cs soil deposition in study area



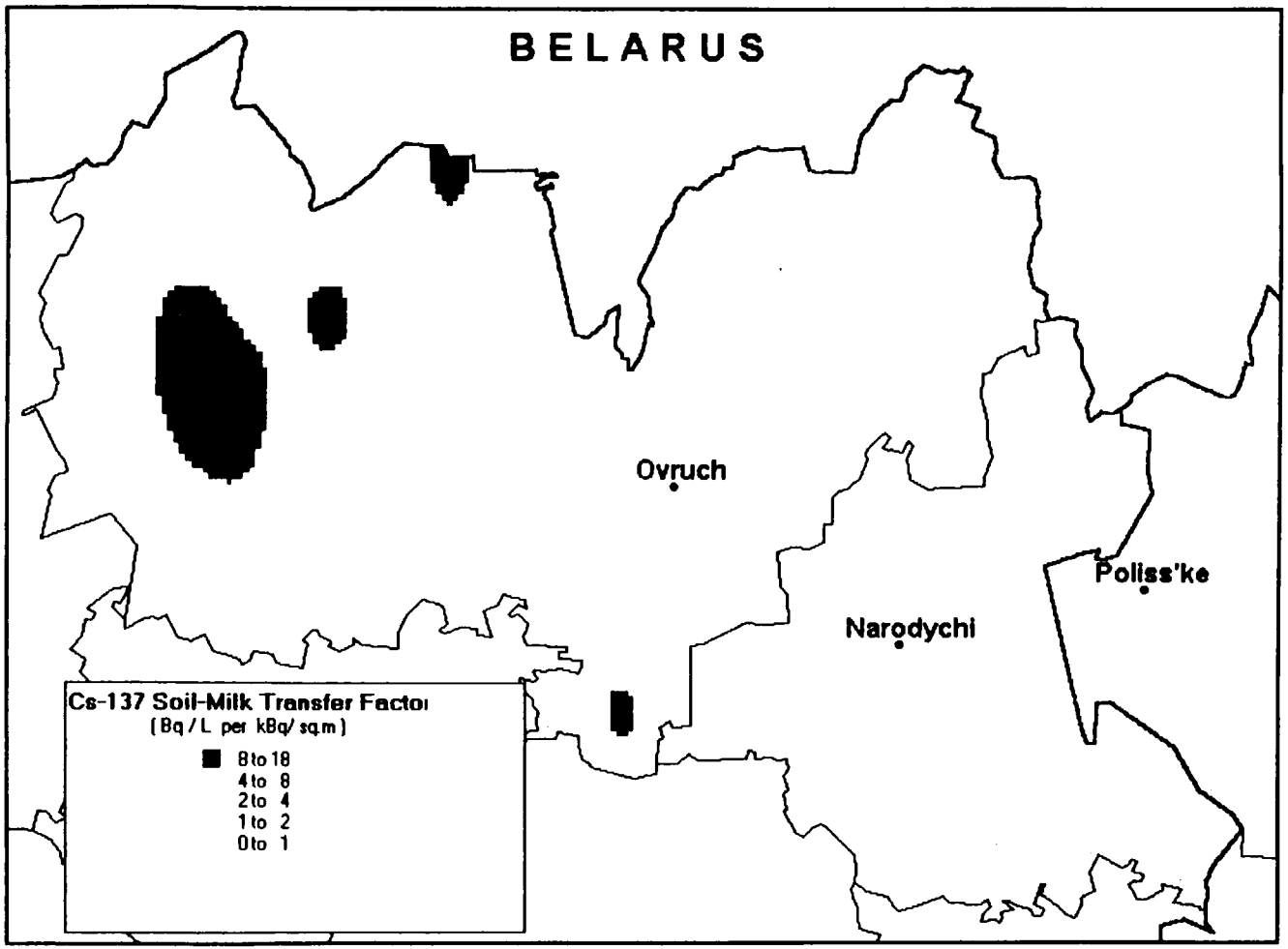
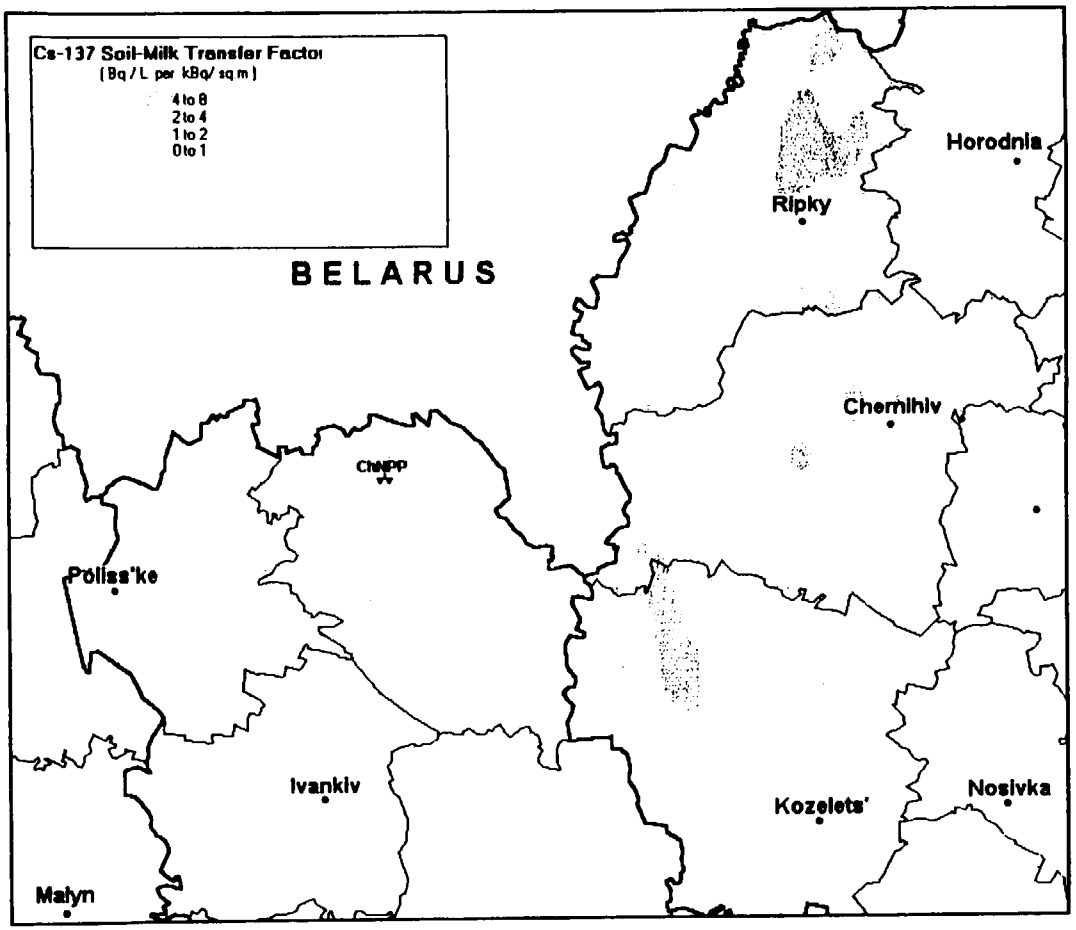


Figure 8.18.2. Spatial distribution of ^{137}Cs soil-milk transfer factors in Narodychs'kyi and Ovruchs'kyi raions.

Figure 8.18.2. Spatial distribution of ^{137}Cs soil-milk transfer factors in Ivankivs'kyi, Polis'skyi, Kozelets'kyi, Ripkins'kyi and Chernihivs'kyi raions



SIMULTANEOUSLY WITH ASSESSMENT OF THE CONTRIBUTION OF SHORT-LIVED IODINE ISOTOPES FOR THIS SUBCOHORT.

A preliminary assessment of the total dose of internal exposure from radiocaesium and external gamma-exposure for the period 1986 to 1997 has been made for more than 2000 rural settlements located in Kyivs'ka and Zhytomyrs'ka oblasts. The technique of assessment of the total thyroid dose accumulated for 11 years from other than ^{131}I sources of exposure, is described in the previous report (milestones 8.16 and 8.17), as well as in publications [2-5]. This dose is compared to estimates of average age-dependent doses of thyroid exposure from ^{131}I in the same settlements. Summing up of equivalent thyroid exposure doses from iodine radioisotopes with equivalent doses of external and internal exposure of this organ at the expense of "caesium" component is admissible, since in the latter case a uniform exposure of all organs and tissues, and therefore of thyroid gland, takes place.

The average contribution of the total dose of external gamma-exposure and internal exposure from radiocaesium, expressed in per cent to the average thyroid exposure dose from ^{131}I, is presented in Table 8.15.2 for three levels of exposure of this organ and three age cohorts. The results point out that the total dose from external gamma-exposure and internal exposure from radiocaesium provides from 0.3% to 0.6% from the iodine dose for the inhabitants of villages, and this part is increasing with age, but it depends to a small degree on the level of iodine exposure.

Table 8.18.2. -Total Chornobyl dose due to external gamma-exposure and internal exposure to $^{137, 134}Cs$ obtained by residents of rural settlements during 1986-1997 (percent to ^{131}I thyroid dose)

Age groups (years of birth)	Total dose due to external and internal $^{137, 134}Cs$ thyroid exposure for different levels of ^{131}I thyroid exposure		
	<0.1Gy	**0.1-1Gy**	**>1 Gy**
1986	0.27%	0.53%	0.58%
1975-1978	2.3%	3.5%	2.1%
1968-1970	5.6%	6.0%	3.9%

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Appendix 1

Dynamics of invitation of patients to the screening

_____oblast, _____raion,

_____ selskiy sovet _____settlement,

_____ Surname of the person filled in the form

1. ID	2. Surname	3. Name	4. Patronymic	5. Last known Address	6. Date of initial contact	7. Result	8. Reason for the refusal	9. New address of patient, if known	10. Date of repeated contact	11. Result	12. Comment

Instruction on filling in the table "Dynamics of invitation of patients to the screening"

1. In the field 7 "result " should be put the following codes

1-, if the patient came for screening,

2-, if the patient agreed to come for screening but didn't show up

3-, if the patient refused to come in suggested time

4-, if the patient definitely refused to participate in screening

5 -, patient left (if so, please, in the field 'new address' state new place of dwelling)

6 -, if the patient left, but there still live relatives, able to send to the patients information about screening

7 -, patient is not found

8 -, patients died

2. Possible reasons for refusal (field 8) are written as following codes;

1-, patient couldn't afford trip to the place of screening

2-, patient couldn't find time for examination

3-, patient is not interested in his health condition and he didn't want to be under the screening in Project

4-, recently was examined under other programs

5-, afraid of drawing the blood

6-, reason of refusal is unknown

7–, other (mention in the field 'Comments')

UKRAINIAN - AMERICAN SCIENTIFIC PROJECT ON THE STUDY OF CANCER AND OTHER THYROID DISEASES IN UKRAINE FOLLOWING THE CHORNOBYL ACCIDENT

Tasks for the 3nd quarter of the 3rd year (December 1998 – February 1999)

	TASK	man*month
	Management and administration	
1.14	To organize screening of cohort members residing in Kozelets raion of Chernihiv oblast on the base of the Clinic of the Institute of Endocrinology and Metabolism of the Acad.Med.Sci. Ukraine, by fixed team.	0.5
1.15	To perform a work in order to use databases of oblast and raion departments of passport registration and migration work of Kyiv, Chernihiv, Zhytomyr oblasts, and of corresponding Department of the Ministry of Internal Affairs of Ukraine in order to specify addresses of residence of potential cohort members.	0.5
1.16	To organize a regular meeting devoted to Project implementation (Ministry of Public Health of Ukraine, administration and participants in the Project).	1.0
1.17	To prepare customs clearance documentation for shipments which arrive in the framework of the Project, and to receive these shipments.	2.0
	Establishment of the cohort	
2.10.	To find addresses of possible cohort members with were resettled for Chornobyl and raion, Pripiat, Polesskiy rayon to other oblast of Ukraine using database of Kyiv oblast healthcare system and oblast passport office.	2.0
2.11.	To identify settlements with substantial number of patients, resettled from contaminated areas and clarify a possibility of their examining.	2.0
	Invitation of patients for endocrinologic screening	
3.1	To finish invitations by the telephone of the cohort members currently living in Kyiv which were resettled from Chornobyl and Prypyat.	1.0
3.6	To finish examination of study subjects who currently live in Ovruch raion, Zhitomir oblast.	1.0
3.10	To obtain consent to take part in screening from cohort members who reside in Narodichi raion, Zhitomir oblast.	1.0
3.11	To obtain and analyze information on study subjects who didn't come for examination in Ovruch rain, Zhitomir Oblast	1.0
	Endocrinologic examination of the subjects	
4.6	To perform screening by mobile teams of cohort members residing in Narodychi raion of Zhytomyr oblast.	21.0
4.7	To perform screening by fixed team, on the base of the Institute of	21.0

	Endocrinology and Metabolism, of cohort members residing in Kozelets raion of Chernihiv oblast.	
	Operation of the Central Laboratory	
5.2	To perform all laboratory investigations in the process of screening.	7.0
	Operation of Data Coordinating Center	
6.15.	To develop software for image processing and introduction from magneto-optical disks into Project database.	1.0
6.16.	To continue data input from Locator Forms into Project database.	5.0
6.17.	To develop software for data input from primary Registration Form.	2.0
6.18.	To transfer available software to SQL platform.	1.0
	Pathology support for diagnosis of various forms of thyroid pathology.	
7.1.	To continue collection and pathology examination of morphologic material from all patients born in 1968 and later from cohort oblasts and having been operated at the Institute of Endocrinology and Metabolism for different thyroid diagnoses.	6.0
7.2	Preparation of additional histological specimens for the morphologic data bank of the Ukr.-Am. Project (after identification of concrete patients included in the cohort).	1.0
7.3	To ensure intraoperational diagnosis, histological processing and pathomorphologic analysis of specimens obtained from patients selected for surgery after screening. Preparation of additional histological specimens for the morphologic data bank of the Ukr.-Am. Project.	1.0
7.4	To fill in the Pathology Forms for the patients with revealed cases of thyroid pathology, included in the cohort under study. To set these data into computer and provide them to DCC (after development of an appropriate computer program by DCC staff).	1.0
	Dosimetry support of the Project	
8.15	Verification of calibration factors on the base of the technique for retrospective assessment of "device"-specific ("list"-specific where it is possible) calibration coefficients.	8.0
8.7.	To continue the support of the questionnaire DB. Establish, augment, and maintain database of personal questionnaire data for cohort members.	12.0
8.19.	Incorporation of information on date and duration of fallout.	8.0
8.20.	Estimation of age-dependent background incidence rate for cohort under the follow-up	4.0
8.21	Practical approval of probabilistic computerized record linkage program on dosimetric data.	2.0